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ON THE POLLEN OF *MICROCACHRYS TETRAGONA*

ROBERT BOYD THOMSON

(WITH PLATES I AND II)

"*Microcachrys tetragona* occurs only on the highest summits of the Western Range and Mount Lapeyrouse in Tasmania. It was introduced to the Royal Gardens at Kew about the year 1857 by Mr. WILLIAM ARCHER, on whose property it grew. Although of great interest in a botanical sense, its only value as a garden plant is for conservatory decoration, for which the elegant habit it can be made to assume under pot culture, its neat foliage, and bright-red fruits render it highly suitable."[1] The specimens for this work were obtained through the kindness of the present director of Kew Gardens, Colonel PRAIN, whose courtesy and that of the staff is much appreciated by the writer.

The general features of the fruiting branches of microsporangiate and megasporangiate plants are indicated in *pl. I*. The cones are borne terminally and their sporophylls are spirally arranged, in contrast to the opposite and slightly concrescent vegetative leaves (*pl. I*, and *pl. II*, *fig. 1*, the branch to the left).

The microsporophylls bear two somewhat spherical, pendant sporangia (*fig. 2*), whose form and structure, after the discharge of the pollen, is indicated in *figs. 3* and *4*. The terminal scale of the sporophyll is broadly triangular in outline (*fig. 2*), very much extended dorsally (*fig. 3*), but not, or scarcely at all, in the ventral direction. The inner layers of the wall are much collapsed at the stage indicated, but the epidermis retains a very definite structure on account of its peculiar thickened bands. These are shown in transverse and in longitudinal section in *figs. 5a* and *5b*.

In *fig. 4* some linear and branched structures are apparent in and around the sporangia. These are the hyphae of a fungus, and to their presence the retention of many of the pollen grains in the dehisced sporangia of my material is due. The hyphae are often in intimate association with the pollen, they frequently branch, and the branches form contact with the grains. This pollen is no different from the less abundant found in uninfected sporangia.

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[1] KENT, ADOLPHUS H., Veitch's manual of Coniferae 161. 1900. The references to the discovery of this form and its description are given here.

The pollen of Microcachrys (*fig. 8*) is small as compared with that of Saxegothaea (*fig. 9*), Podocarpus (*fig. 10*), or Pinus (*fig. 11*), all these figures being the same magnification for the purpose of comparison. The grains vary considerably in size, a feature which my material of Saxegothaea also shows. They are winged, though in some instances I have thought that no wings were present, but more material was needed to determine this point than was at my disposal. The wings arise in the ordinary way by a separation of the exine from the intine. In longitudinal section the grains usually show two rather poorly developed wings (see various grains in *fig. 6*), and in following the series these two are often all that one can be certain of. In gross material, however, three wings are readily apparent (*fig. 8*).[2] In transverse sections, also, which pass through the ventral part of the grain, the three-winged condition is clearly seen (see middle of *fig. 6*). In some cases one of the wings is very small (*fig. 6*, grain in upper part of the field). The lowest grain in *fig. 6* shows the presence of four wings (the central one very dark). Some four-winged grains have one pair of wings much smaller than the other. Exceptionally, five and six-winged grains are found. A student, Mr. W. P. THOMPSON, kindly made a careful determination of the number of wings in gross material from several cones, rolling the grains in fluid under the cover glass. He found that of sixty-four grains, fifty were three-winged, three of these having one very small wing; nine were four-winged; two had five, and three had six wings. The pollen studied was in the mature condition and the wings must have been fully developed. *Fig. 7* shows the greatest expansion of the wings that I have observed. They usually do not extend laterally beyond the body of the grain (*fig. 8*, also some grains in *fig. 6*). They project, however, beyond the body of the grain ventrally, though not to such a degree in either direction as do those of Podocarpus (*fig. 10*) or Pinus (*fig. 11*). A small amount of material from the apex of one of the cones showed another feature. When the pollen grain has a five-celled gametophyte, the wings are very small, not much larger than they are in Pinus when its pollen is still in the tetrad condition. The wings of Microcachrys arising thus late ontogenetically give indication of their recent acquirement.

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[2] I studied the grains in section first, and this led me to misinterpret the number of the wings, as stated in BOT. GAZETTE **46**:465, 466. 1908.

With regard to the microgametophyte, I find that in the mature condition of the pollen four prothallial cells are often present, though three are more usual. When three only are present, it is the second prothallial cell that has divided (*fig. 7*). The first and second prothallial cells have walls which turn blue with chlor-iodide of zinc. No further cellulose walls were demonstrated. *Fig. 7*, in addition to the prothallial cells, shows a lateral derivative of the body cell and the tube nucleus. The gametophytic structure thus conforms to that which recent investigators have shown characterizes the related forms. Perhaps it is not out of place here to give credit to THIBOUT,[3] the first person, so far as the writer knows, to describe and figure a multicellular gametophyte in the Podocarpeae.

NORÉN in his recent work on Saxegothaea[4] has emphasized the relationship of this form to the Araucarieae. He finds that, in addition to the supernumerary prothallial cells, there is a curious reminiscence of this group in the mode of pollination, the pollen sometimes being deposited in the cavity around the ovule and growing over the tissue into the micropyle, a condition which so far as can be judged is essentially similar to that which I have found in Agathis. He also calls attention to the wingless condition of the pollen in both Saxegothaea and the Araucarieae.

With the present contribution our knowledge of the occurrence of excess prothallial tissue in all genera of the Podocarpeae is complete. The winging of the grain in Microcachrys is of varied and indefinite character, late in development, and undoubtedly of primitive type, the form occupying in this respect an intermediate position between Saxegothaea on the one hand and Dacrydium and Podocarpus on the other. This is the more evident from the presence of three wings in some species of Podocarpus. THIBOUT describes the

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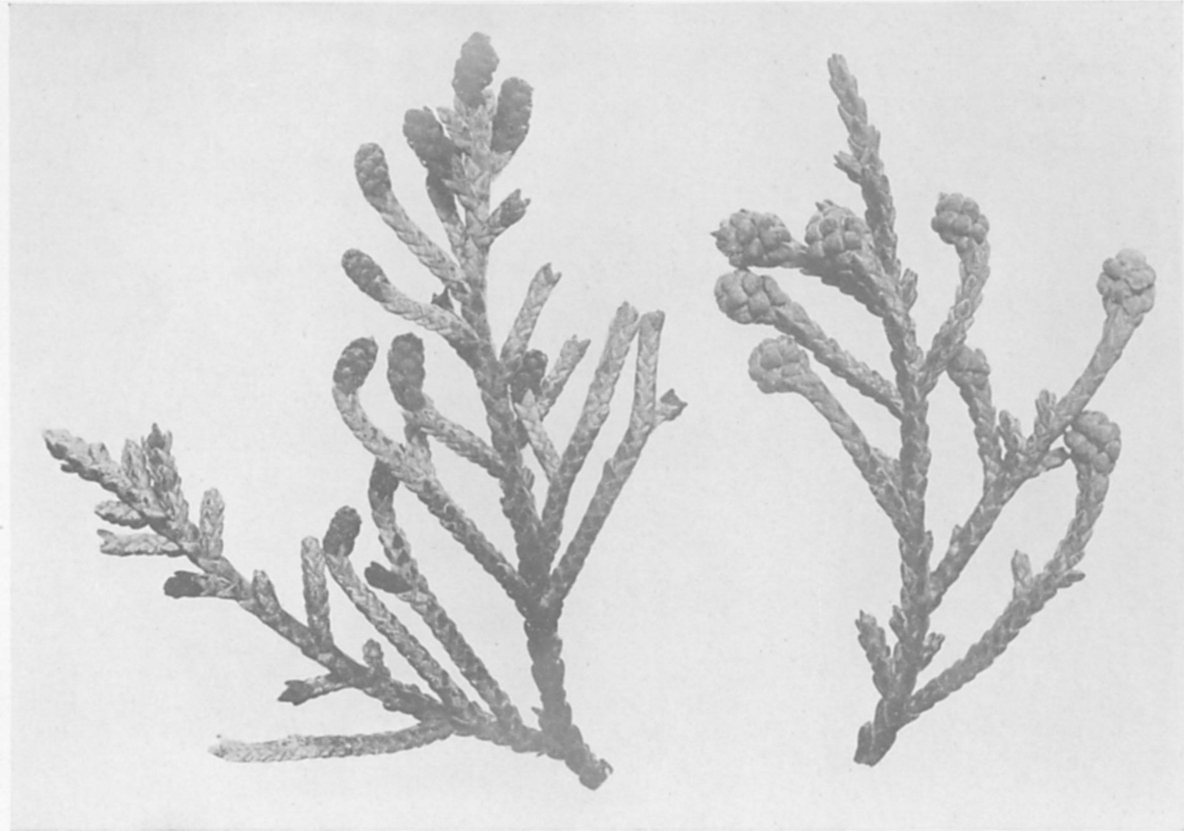
[3] THIBOUT, E., Recherches sur l'appareil mâle des gymnospermes. pp. 265. *pls. 16.* Lille. 1896. See *pl. 14, figs. 8* and *9*, of *Podocarpus polystachya.*

[4] NORÉN, C. O., Zur Kenntnis der Entwicklung von *Saxegothaea conspicua* Lindl. Svensk. Bot. Tidskr. **2**:101–122. *pls. 7–9.* 1908.



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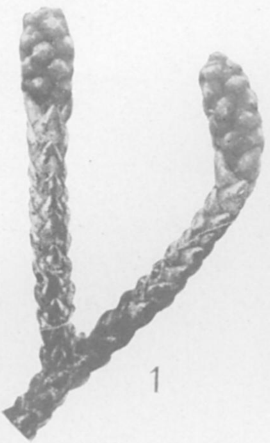
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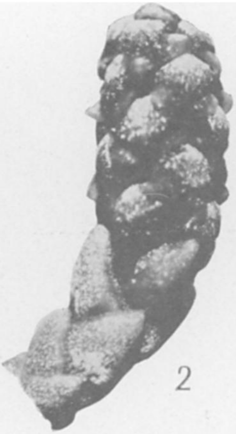
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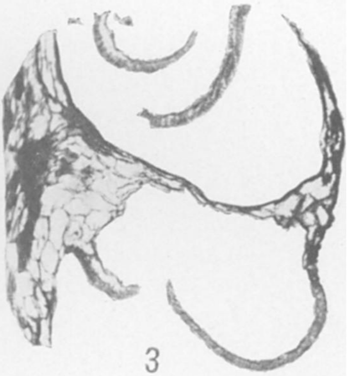
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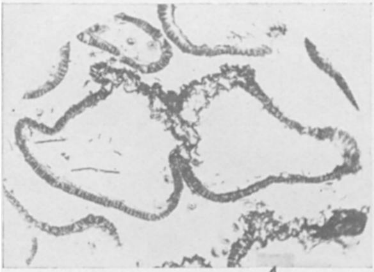
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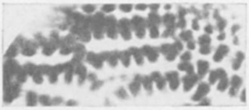
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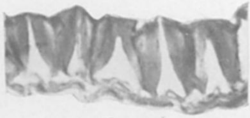
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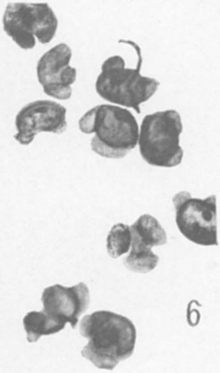
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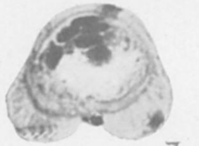
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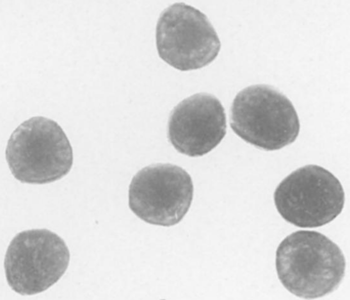
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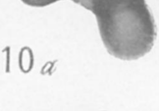
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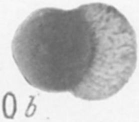
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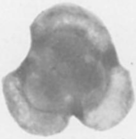
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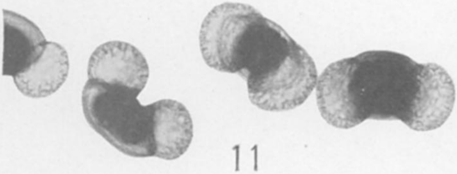
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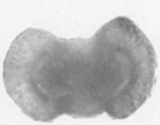
10 *c*

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pollen of *P. dacrydioides* as having normally three wings (*op. cit., pl. 14, figs. 10, 11*). I have found three wings present exceptionally in the usually two-winged *P. ferruginea* (*fig. 12*). Unfortunately, no data nor material of the more probable genus Dacrydium were available.

The bi-winged condition of the pollen on the pines and podocarps has often been referred to as an indication of affinity between the groups. This view has no longer support, since the winging of the grain has arisen in the Podocarpeae within the group itself, and so is distinct from that of the pines. In a further contribution on the character of the megasporophyll of Saxegothaea and Microcachrys, the writer hopes to show the essential difference of this structure in the two great phyla of the conifers.

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EXPLANATION OF PLATES I AND II

PLATE I

Twigs from staminate and ovulate plants. ×2.25.

PLATE II

FIG. 1.—Branch with microsporangiate cones. ×4.

FIG. 2.—One of the same enlarged; the sporangia can be seen in pairs beneath the terminal scale of the sporophyll. ×9.

FIG. 3.—A microsporophyll in longitudinal section, to one side of the axis.

FIG. 4.—Same in transverse section; the linear structures in the sporangium are the hyphae of a fungus shown in contact with pollen grains in *fig. 6*.

FIG. 5*a*.—The wall of the microsporangium in tangential section.

FIG. 5*b*.—The same in transverse section.

FIG. 6.—A field of sectioned pollen grains; below is one with four wings; above it one with three wings cut transversely and a small part of the body uniting these; various other aspects of the wings.

FIG. 7.—The microgametophyte.

FIGS. 8–11.—Pollen grains at same magnification: *fig. 8*, Microcachrys, from below; *fig. 9*, Saxegothaea; *fig. 10*, *Podocarpus ferruginea* (*a* and *b* two latera views at right angles; *c*, dorsal view); *fig. 11*, *Pinus resinosa.*

FIG. 12.—A three-winged grain of *Podocarpus ferruginea.*